the same colour, terminating beneath second median nervule, where it is narrowest; the outer margin also darker brown, with the apex and extreme margin pale violaceous. Posterior wings with the basal fourth dark chocolate-brown, with a narrow outer violaceous margin; a small chocolate-brown spot margined with violaceous above the submedian nervure, a narrow waved central violet-margined fascia crossing disk, strongly fractured at end of cell, and then more narrowly continued to internal nervure; this is followed by a short and somewhat broken fascia, commencing at lower subcostal nervule and narrowly terminating at lower median nervule, the whole outer margin broadly infuscated, the apex and extreme margin pale violaceous. Body and legs more or less concolorous with wings.

Exp. wings, ♂ 51 millim.

Hab. Perak (*Künstler*, Calcutta Mus.).

This beautiful species, of which I have only seen two male specimens, belongs to the *Apidanus* section of the genus.

XXVII.—*On the Rate of Development of the Common Shore-Crab* (Carcinus mænas). By George Brook, F.L.S.

[Plate VII.]

For over two years now I have been carrying on a series of experiments in my aquarium, with the object of throwing some light on the rate of development of *Carcinus mænas*. For this purpose from twenty to thirty specimens have been kept and isolated, and every cast shell has been carefully preserved and labelled. I should have liked, if possible, to have traced this development from the newly hatched Zoëa, but although I have had thousands of Zoëæ hatched in confinement I never yet succeeded in rearing any past the second or third moult. In August last, however, I collected a few of the Megalopa stage of *Carcinus* at Redcar, which at the next moult assumed the ordinary adult form of the Brachyuran. As soon as this stage was reached there was no difficulty in feeding them; and I am now able to combine twelve months' observations on this gathering with the material I had obtained from other specimens.

Mr. C. Spence Bate, in his paper on the "Development of Decapod Crustacea" (Phil. Trans. 1858), gives a full account of the changes gone through by the young *Carcinus* from leaving the egg to assuming the adult form. He says (p. 597):—"Having pursued the course of development from the larva to the mature form of the Brachyuran decapod

. . . . . we perceive that the progress made is not by any sudden metamorphosis, but by a series of moultings similar to those which take place in the adult; and that with each successive moult there is a corresponding degree of progress in its development. But the amount of change at each moult is so little, that it gives to the animal but a very small degree of difference in its general appearance; and it is only by a comparison of the earliest form with the last, and that without any consideration of the intermediate stages in its growth, that the idea of a true metamorphosis in Decapod Crustacea has existed. There are six or seven well-marked stages or forms that the growing animal passes through in its progress to maturity, and each of these is linked to the preceding as well as to that which follows, by a succession of changes that are but just appreciable." And again (p. 596), "Successive moults rob the young animal soon of the frontal spine. Contemporary with its decreasing importance, the *pleon* becomes gradually folded nearer and nearer, until it is closely compressed against the inferior surface of the *pereion*."

This appears perfectly true of the development of the *Zoëa* into the *Megalopa*, and up to a certain point the *Megalopa* approaches nearer and nearer the adult form with each moult. The last stage which can be called a *Megalopa* is shown in fig. 1. Here the frontal spine is very much reduced in size, and the dorsal one has disappeared altogether. The *pleon* is very much reduced also, and in its natural position is sickle-shaped, showing that ultimately it will be curled under the *pereion*. There is also a ridge forming on each side of the carapace, which is to be pushed forward and form the lateral toothed margin of the adult. The next moult is, however, a comparatively sudden change to the true Brachyuran form. The frontal spine is lost, the pleon is now curved under the pereion, and the ridge which was seen in the hepatic region of the carapace now forms the lateral toothed margin (fig. 2). All the development up to this stage has been gradual and preparatory, but now the last traces of larval form are thrown off all at once, and, generally speaking, it may be said that afterwards the animal only grows larger. Of course the carapace is not yet of the shape it will ultimately have; but what I wish to enforce is, that at this particular moult the larval characters are lost and the adult ones assumed.

Dr. Brooks in his 'Invertebrate Zoology,' gives in figs. 110 and 117 drawings of the Megalopa of *Callinectes hastatus*, and of the young crab which hatches from it. These figures agree in every respect with what has been here stated as to *Carcinus mœnas*.

In Mr. Spence Bates's figure of the pleopoda of the Megalopa the last pair are not drawn correctly, unless the specimens I observed were abnormal. The pleopoda usually consist of two joints, the basal one of which has a protuberance on the inner margin, while a large number of fine bristles arise from the apical portion of the long spathulate terminal joint; but the last pair consists of two short thick joints, with only five strong bristles arising from the terminal joint (see fig. 1 *a*). Thus even in the Brachyuran larva there is an indication of the fan-like plates into which these appendages are developed in the Macrura.

The *Megalopa*-stage from Redcar was collected on the 25th of August, 1883, and below I give a list of the moults already gone through for two individuals. I had five altogether, and four out of the five followed the moults of A within a day or two so long as they lived; while B, which seemed somewhat a retarded specimen in its earlier moults, is now a fine young crab with a carapace 12·4 millim. long and 15·5 millim. broad.

	A.	B.
Ecdysis to adult form	26. VIII./83	28. VIII./83
1st ecdysis	5. IX./83	15. IX./83
2nd „	20. IX./83	11. X./83
3rd „	16. X./83	1. XI./83
4th „	14. XII./83	29. I./84
5th „	8. III./84	23. IV./84
6th „	dead.	6. VI./84
7th „	....	9. VII./84
8th „	....	2. VIII./84

In the Plate will be found drawings of the Megalopa and the first six ecdyses of form B, drawn to scale, so that a careful comparison may be made of the whole series.

Fig. 2 represents the form assumed after leaving the *Megalopa*-stage. The carapace is still a little longer than broad; the rostrum continues to occupy about one fifth of the whole area of the carapace, but the frontal spine has been lost, and is now only represented by a slight undulation. This margin

does not develop the three lobes, as in the adult form, until after several moults. They are first indicated by a slight depression on each side of the median line; the frontal margin after the 6th ecdysis is more undulating than in any of those preceding it, and after the 7th ecdysis the three lobes appear; but several more ecdyses have to be gone through before they obtain their normal proportions. From fig. 2 to fig. 7 the carapace assumes its normal shape by a gradual increase in its width compared to its length. With each successive moult the lateral toothed margins are pushed more forward, and the teeth become more prominent.

In the following Table I have represented the measurements of forms A and B at each ecdysis from the Megalopa onwards in millimetres, the figures above the line representing the length of the carapace and those below the width. I have then endeavoured to fit in measurements of ten other individuals which have been collected in the adult form, in in order, if possible, to form an approximate idea of the number

	A.	B.	Z.	No. 8.	P ♀.	B′ ♀.	D ♀.	C ♂	N ♂.	M ♂.	Y ♂.	*a* ♂.
Megalopa....	1·43 / 0·93	1·43 / 0·93										
Ecdysis 1 ..	1·60 / 1·52	1·69 / 1·60										
„ 2 ..	(2·1 / 2·3)	2·15 / 2·32	2·15 / 2·28	2·32 / 2·62								
„ 3 ..	2·66 / 3·02	2·75 / 3·09	2·62 / 2·96	2·75 / 3·3 4								
„ 4 ..	3·17 / 3·72	3·51 / 4·19	3·59 / 4·14									
„ 5 ..	3·72 / 4·48	(4·6 / 5·2)										
„ 6 ..	4·44 / 5·07	5·7 / 6·7	..	..	5 / 6							
„ 7 ..	..	7·5 / 8·9	..	..	6·5 / 7·5							
„ 8 ..	..	9·6 / 11·6	..	..	8·5 / 10	..	..	..	..	..	..	10 / 12
„ 9 ..	..	12·4 / 15·5	..	..	11 / 14	..	13 / 16	13 / 16	12·5 / 15·5	11 / 13	12 / 14·5	12 / 15
„ 10 ..	..	..	..	..	16 / 19·5	..	17 / 22	17·5 / 23	15 / 18·5	14 / 17·5	17 / 20	16 / 20·5
„ 11 ..	..	..	..	..	21 / 26·5	21 / 26	22 / 28	24 / 30·5	18 / 23	18 / 23	22 5 / 29	
„ 12 ..	..	..	..	..	..	28 / 35	..	..	22 / 29	24 / 31	32·5 / 39	
„ 13 ..	..	..	..	..	..	33 / 42	..	..	29 / 37	..	42 / 51	
„ 14 ..	..	..	..	..	..	..	..	..	37 / 45	..	45 / 56	

of ecdyses a specimen of any given size may have gone through. The Table may not, therefore, be scientifically accurate, but will serve my purpose. The measurements in themselves are correct; but I cannot, of course, be sure that specimen P, for example, which was 5×6 millim. when I got it, had already cast its shell five times from the Megalopa; but the measurements appear sufficiently near to those of A and B at that stage to warrant me in concluding that, at any rate, I am not far off the mark.

The dates corresponding with the above ecdyses are as follows:—

A and B have been already given.
Z. 19. VIII., 2. IX., and 15. IX., 82.
No. 8. 25. IV. and 28. V. 83.
P. 3. VII. 82, 29. VII., 16. VIII., 10. IX., 1. II., 83, 16. V.
B′. 2. VI. 82, 23. VII. and 25. V. 83.
D. 22. IV. 82, 10. VI., 21. VII.
C. 17. IV. 82, 8. VI., 16. VII.
N. 18. VII. 82, 17. VIII., 2. X., 5. II., 83, 21. V. and 21. VIII.
M. 12. V. 82, 12. VI., 16. VII., 17. VIII.
Y. 4. IX. 82, 5. X., 28. XI., 27. II., 83, 15. VI.
(*a*). 3. IX. 82, 7. X., 2. II., 83.

It will be seen from the above dates that out of a record of fifty-four ecdyses there is only one that occurs between the end of October and the beginning of February, while the majority are in the summer months. D and C cast their shells about the same time, and increased to about the same extent at each ecdysis. Y, on the other hand, was only the same size in September which D and C had attained in May. Again, comparing N and Y, the former only increased from 15·5 millim. to 45 millim. in ten months, whereas the latter grew from 14·5 to 56 millim. in nine months, and with the same number of ecdyses.

It would appear, then, impossible to judge either the age of any particular specimen or the number of ecdyses which it has passed through from a casual observation of it on the sea-coast, and even in confinement a number of ecdyses must be passed through before any reliable information is obtained. B′, for instance, passed through two ecdyses in the summer of 1882, and then did not cast its shell again until May 1883. N & Y, on the other hand, grew considerably larger than B′ without any such break. In attempting to guess the size A and B would be two years after hatching, A may be taken as a backward form, which would perhaps follow the ecdyses of such a form as P. In that case, next June, A would measure about 28 millim. long by 35 millim. broad. If B, on the other hand, which is a strong forward specimen, should

increase to the size of Y by September, it might then be 45 millim. by 56 millim. by next June. It is also probable that in confinement the young *Carcini* do not develop exactly with the same rapidity as they would in their natural haunts. Doubtless the environment, the temperature, and possibly also the quantity of water and the amount and nature of the food available will all have their influence on the rapidity of growth.

PROCEEDINGS OF LEARNED SOCIETIES.

DUBLIN MICROSCOPICAL CLUB.

October 18, 1883.

Campanularia verticillata.—Prof. Macintosh exhibited a specimen of *Campanularia verticillata* differing from the type of the species in that the calicles have even rims instead of denticulate ones. The specimen was dredged in about 12 fathoms water off Greystones.

Sections of Chiton.—Prof. Haddon exhibited transverse sections of *Chiton* (*Trachydermon*) *ruber*, showing the presence of an oviduct, contrary to W. H. Dall's statement, the so-called "ovarian fenestræ" being merely the folded lips of the external openings of the oviducts.

Spore-bearing Nostoc.—Prof. M'Nab exhibited a portion of an unidentified *Nostoc* (which had presented itself in one of the conservatories at Glasnevin Botanic Gardens) in a fertile condition, that is to say, showing spores; these occurred in chains of several in a continuous row, elliptic and notably wider than the ordinary joints of the filaments, and seemingly showed no very noticeable relative distribution as regards the heterocysts. This is the second fertile *Nostoc* which has been noticed in this country, though several species have been found in that condition by Dr. Bornet, who has been so successfully studying the group.

Characters of the Hairs of Acanthus spinosus.—Mr. Greenwood Pim showed hairs from the anthers of *Acanthus spinosus*. These were of two kinds—one short and straight, forming a thick close brush along the edges of the suture of the anthers; the other longer and more flexuous, and situated on the dorsal portion of the anthers. The short straight hairs had their surfaces curiously reticulated into labyrinthiform folds of every conceivable shape, whilst the dorsal hairs were only longitudinally striate. The position of the latter differed according as they were growing on one of the posterior pairs of stamens, whose anthers are in apposition, or on the anterior pair, which are free throughout.